Before the
Federal Communications Commission
Washington, DC 20554

In the matter of	)	
	)	
Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules	)	WT Docket No. 99-168
	)	
Carriage of the Transmissions of Digital Television Broadcast Stations	)	CS Docket No. 98-120
	)	
Advanced Television Systems and Their Impact upon the Existing Television Broadcast Service	)	MM Docket No. 00-39

SECOND MEMORANDUM OPINION AND ORDER

Adopted: January 2, 2001 **Released:** January 12, 2001

By the Commission:

I. INTRODUCTION

1. By this Order, we affirm the decision we reached in the *700 MHz Memorandum Opinion and Further Notice of Proposed Rulemaking* (*MO&O*) modifying our 700 MHz service rules to permit base station transmitters to operate in both the lower and upper commercial 700 MHz bands.[1] We find that this change should not cause additional interference for public safety operations. Moreover, the modified rules allow for the broadest possible use of this spectrum, consistent with sound spectrum management and will expand participation in the auction and increase the potential for new technologies and new services. In developing these rules we were guided by our commitment to avoid causing additional interference for public safety operations and our conclusions in our *Spectrum Reallocation Policy Statement*[2] that a flexible, market-based approach is the most appropriate method of establishing service rules for this spectrum. Thus, we affirm that base station

[1] Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, Carriage of the Transmissions of Digital Television Broadcast Stations, CS Docket No. 98-120, Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, MM Docket No. 00-39, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, FCC 00-224, rel. June 30, 2000 (*MO&O*), 2000 WL 870832 (2000).

[2] Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, *Policy Statement*, FCC 99-354, rel. Nov. 22, 1999 (*Spectrum Reallocation Policy Statement*), 1999 WL 1054886 (1999).

transmitters should be permitted to operate in the upper 700 MHz commercial band and deny the petition for reconsideration of this issue.

II. BACKGROUND

2. In the *700 MHz First Report and Order*,[3] we adopted service rules for commercial operations on the 747-762 MHz ("lower block") and 777-792 MHz ("upper block") bands that followed the base/mobile designations previously adopted to govern operations in the adjacent public safety frequency bands, at 764-776 and 794-806 MHz.[4] Section 27.50 of our Rules required commercial base stations to transmit in the lower block frequencies and corresponding mobile stations to transmit in the upper block frequencies.[5]

3. In the *MO&O*, in response to several petitions for reconsideration, we modified Section 27.50 of our Rules to enable both base and mobile station transmitters on both the 777-792 MHz and 747-762 MHz spectrum bands.[6] We found that the rules, as originally adopted, inadvertently and unnecessarily limited the potential for new and innovative service offerings on these bands.[7] We determined that the revised rules would broaden the range of technologies and potential services represented in the auction process, and better enable the market to evaluate the asserted benefits of those technologies and services, without causing additional interference to public safety operations.[8] This modification also enabled licensees to configure their systems so as to avoid potential interference to mobile receivers operating in the lower block frequencies from television broadcast stations transmitting on TV Channels 56-59.[9]

4. In August of last year, Motorola, Inc. ("Motorola") filed a petition for reconsideration

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[3] Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules, WT Docket No. 99-168, *First Report and Order*, 15 FCC Rcd 476 (2000) (*700 MHz First Report and Order*). *See also Erratum*, 15 FCC Rcd 8634 (2000); *Errata*, DA 00-2094, rel. Sept. 14, 2000.

[4] Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010, WT Docket No. 96-86, *First Report and Order and Third Notice of Proposed Rulemaking*, 14 FCC Rcd 152 (1998).

[5] *700 MHz First Report and Order*, 15 FCC Rcd at 521-522 (para. 111), 547-548 (Appendix B, Final Rules, § 27.50(a)).

[6] *MO&O* at paras. 6-10.

[7] *Id.* at paras. 6-7.

[8] *Id.* at paras. 7-9.

[9] *Id.* at paras. 6, 10. Our initial rules required base station transmitters, and thus mobile receivers, to operate in the lower 700 MHz band. This caused concern about potential interference to these mobile receivers from high-powered television stations operating on nearby TV Channels 56-59. By allowing base station transmitters, and thus mobile receivers, to operate in the upper 700 MHz band, we enabled such receivers to operate on spectrum somewhat removed from TV Channels 56-59, thereby reducing the likelihood for interference.

or clarification of the *MO&O*.[10] Four parties filed oppositions to Motorola's petition.[11] Motorola filed a reply to the oppositions. In this Order, we address the issues raised in these filings.

III. DISCUSSION

5. **Background**. Motorola seeks reconsideration of our decision to modify our rules to allow base station operations in both the upper and lower commercial bands on the grounds that the rule modification will result in objectionable interference from base station transmitters in the commercial 777-792 MHz band to public safety base station receivers operating in the nearby 794-806 MHz block. In particular, Motorola asserts that commercial base stations operating in the upper band will cause interference to public safety base stations "even when affected base stations are separated by 3 miles."[12] Opposing parties challenge Motorola's conclusion, taking issue with certain technical assumptions that Motorola employed in its calculations. Specifically, TRW, Adaptive, and BellSouth contend that Motorola's notion that a 1 dB rise in the noise floor would result in a disruption to public safety communications is unreasonable.[13] Additionally, ArrayComm, Adaptive, and TRW argue that Motorola's assumption of a 0 dB clutter factor (*i.e.*, the assumption that there would be no signal attenuation between commercial and public safety base stations due to natural or man-made obstructions) is unrealistic.[14] APCO, in a December 21, 2000 *ex parte* letter, supports Motorola's petition, and urges us to review our service rules for the commercial portions of the 700 MHz band and take appropriate steps to protect public safety communications.[15]

6. **Discussion**. While we remain committed to ensuring that operation of commercial wireless services in the 700 MHz band does not impair public safety operations in nearby spectrum,[16] we reaffirm our decision to modify our rules to permit base station transmitter operations in the upper commercial band. We disagree with Motorola that this rule change will cause additional interference to public safety operations. In the *MO&O*, we denied similar arguments by Motorola on the grounds

[10] Public notice of the petition was published on August 31, 2000. *See* Federal Communications Commission, Petition for Reconsideration and Clarification of Action in Rulemaking Proceeding, Report No. 2432, 65 FR 53016, Aug. 31, 2000.

[11] Oppositions were submitted by Adaptive Broadband Corporation ("Adaptive"), ArrayComm, Inc. ("ArrayComm"), BellSouth Corporation ("BellSouth"), and TRW Inc. ("TRW").

[12] Motorola Petition at 7.

[13] Adaptive Opposition at 2 n.3, Annex 1 at 1; BellSouth Opposition at 5-6; TRW Opposition at 3.

[14] ArrayComm Opposition at 4 (propagation assumptions "cannot be expected to be representative of typical deployments"); Adaptive Opposition, Annex 1 at 2-3 (free space propagation formula "is generally held to be completely valid only for satellite communications paths"); TRW Opposition at 3 ("Motorola propagation calculations—based on assumed free-space propagation—are wholly irrational and irrelevant").

[15] *See* Letter from Lyle Gallagher, President of Association of Public-Safety Communications Officials International, Inc. ("APCO") to William Kennard, Chairman, FCC, dated December 21, 2000 (*APCO Letter*).

[16] *See 700 MHz First Report and Order*, 15 FCC Rcd at 490-491 (para. 33).

that Motorola had not provided any analysis to support the assertion that permitting base stations to operate in the upper band would cause greater overall harmful interference to public safety operations.[17] On reconsideration, we are unpersuaded by Motorola's newly submitted technical analysis[18] that further modifications to our rules should be made. As fully discussed below, we agree with commenters that Motorola's technical assumptions are overly pessimistic and restrictive and lead it to conclude incorrectly that public safety base stations within 4.8 km of a commercial base station will experience unacceptable interference.

7. First, we disagree with Motorola's initial premise regarding the strength of an interfering signal that would cause objectionable interference to public safety receivers. Specifically, Motorola contends that adding an interfering signal of a strength 6 dB below the existing noise floor,[19] which would result in an increase of 1 dB to the noise floor, will cause such a level of interference.[20] By assuming that such a minimal increase in the noise floor will result in objectionable interference, Motorola in effect is arguing that we need to exclude commercial base station transmitters located within 4.8 kilometers of public safety base station receivers, rather than expecting public safety systems to be designed with safety margins adequate to withstand such a commercial transmission. We find Motorola's assumption that a 1 dB increase in the noise floor will result in objectionable interference to be unreasonable and overly restrictive. As TRW states, "it is unreasonable to assume . . . that a 1 dB rise in noise threshold will necessarily disrupt communications in fringe areas."[21] BellSouth similarly asserts that this minimal degradation in a public safety radio's noise threshold "does not represent anything close to an outage situation," and "would be unnoticeable to any user of a public safety radio."[22] Adaptive also believes that a 1 dB rise in the noise threshold, "for the vast majority of situations," will have "no effect at all on communications" because "public safety communications systems will be designed with adequate safety margins so that [public safety] transmissions within their designed coverage area will not be received at threshold levels."[23]

8. Motorola argues that the – 6 dB interference level that it employed in its calculations, which generates the 1 dB increase in the noise floor, is consistent with the interference thresholds advocated by NTIA and FLEWUG in filings earlier in this docket and should therefore be accepted

[17] *MO&O* at para. 9.

[18] *See* Motorola Petition at Appendices A and B.

[19] The noise floor represents the total "background" noise within a receiver. The ability of a receiver to accept a desired signal and produce a sound of a particular quality is dependent on the degree to which the desired signal exceeds the receiver's noise floor.

[20] Motorola Petition, Appendix A at 6.

[21] TRW Opposition at 3.

[22] BellSouth Opposition at 5-6.

[23] Adaptive Opposition, Annex 1, at 1 (arguing that public safety systems would not be designed in such a way as to require a public safety receiver to detect signals at levels near the receiver's noise floor).

by the Commission for use in any interference protection calculations.[24] Although Motorola's interference threshold estimate is consistent with the interference thresholds advocated by NTIA and FLEWUG, we find that such a limit is unduly pessimistic in assessing the design characteristics of public safety systems. Rather, public safety systems are more likely to be designed so that an interfering signal greater than 10 dB above the noise floor would have to exist before a disruption to communications would occur. Specifically, public safety systems are likely to be designed so that a reliable, desired signal from a transmission at the fringe area of a system would be 10 dB above the weakest serviceable signal in the absence of interference, which we believe to be a signal that is 20 dB above the noise floor.[25] To protect such a signal from interference, we determine that the interfering signal can be no more than 10 dB above the noise floor. Protecting against such an interference level, rather than the – 6 dB interference level employed in Motorola's calculation, reduces from 4.8 kilometers to 767 meters Motorola's estimate of the minimum distance that a commercial base transmitter would have to be from a public safety base receiver to avoid interference.

9. We find that Motorola's threshold assumption, that a quite minimal noise floor increment represents objectionable interference, is significantly more stringent than the level of protection to public safety services granted by the *700 MHz First Report and Order*.[26] We remain committed to the overall protection of public safety services,[27] but we see no need to provide the implicitly requested degree of protection at this time.

10. Second, while there may be instances where line-of-sight conditions could exist between a public safety and a commercial base station, thus yielding a 0 dB clutter factor, we believe that it is much more likely that very few such instances will occur -- that is, we believe that in the vast majority of cases there *will* be intervening obstructions between public safety and commercial base stations, which will result in a clutter factor of greater than 0 dB.[28] We therefore disagree with Motorola's across-the-board assumption of a 0 dB clutter factor to describe the signal attenuation between commercial and public safety base stations due to natural and man-made obstructions. In

[24] Motorola Reply at 3-4 (referring to submissions by NTIA and FLEWUG filed in response to issues raised in the context of the *700 MHz First Report and Order*). We have not, however, reached, in any decisions in this proceeding, any conclusions as to appropriate acceptable levels of interference to public safety receivers.

[25] A signal of this level, *i.e.*, 30 dB above the noise floor, could generally be received at a public safety base station from a portable radio operating at the fringe of a 10-mile public safety system service area. A 20 dB signal-to-noise ratio correlates to a voice quality that might be expected for fringe-area public safety communications in the absence of interference. (*See* TIA/EIA Telecommunications Systems Bulletin 88A, p. 23).

[26] *See 700 MHz First Report and Order*, 15 FCC Rcd at 518-519 (para. 104): "[E]ven the most stringent OOBE limits do not guarantee there will never be any interference under any circumstance between commercial and public safety licensees."

[27] *MO&O* at para. 26.

[28] For public safety and commercial base stations that are located roughly 500 meters to 1000 meters apart, we would estimate a clutter factor of about 5 dB. If such a factor is assumed, then the previously-calculated 767 meter interference distance is further reduced to 432 meters. This result represents a considerably less serious interference scenario than suggested by Motorola.

our view, such an assumption results in an unrealistic assessment of the general impact of commercial base stations on public safety base operations.

11. Third, from the outset, the 700 MHz service rules permitted fixed stations in the upper, 777-792 MHz band, and base station transmitters in the lower, 747-762 MHz band, with the requirement that all such stations comply with our OOBE standards with respect to the 794-806 MHz public safety band.[29] In its filing, Motorola does not indicate why base stations operating in the upper band will now cause serious interference problems when no such claim has been raised with respect to the fixed stations operating in that band.[30] Given that the degree of interference that would be caused by a base station would be comparable, if not identical, to the degree of interference that would be caused by a fixed station, we find no basis upon which to now modify our rules for an interference scenario that has, in effect, existed since the initial adoption of the rules for the 700 MHz commercial bands approximately a year ago.

12. Finally, we note that any mitigation measures that might be implemented in individual cases to address potential interference are very likely to be effective because the interference scenario described by Motorola involves potential interference between stations situated at fixed locations (as opposed to the more complex scenarios involving interference between base and mobile stations). Also, because of the inherent differences between commercial and public safety system architectures,[31] potential interference to a public safety base station receiver would likely be caused only by those few commercial base stations that might be located in the vicinity of the public safety station.[32] Therefore, any required mitigation measures would involve only a small percentage of a commercial licensee's base stations.

13. For these reasons, we decline to adopt rules -- as recommended by Motorola -- that would restrict operations in the 700 MHz band, and thereby preclude the provision of the widest variety of commercial services, in an effort to protect against potential interference scenarios that we believe are highly unlikely to occur. Where instances of interference actually occur, however, we believe that they can be readily addressed on a case-by-case basis, and that historically-followed coordination procedures, requiring cooperation and accommodation by both commercial and public safety entities, will generally be able to resolve such interference. Should routine coordination

[29] Base stations communicate with mobile and portable stations, and fixed stations communicate with other fixed stations. Our OOBE standard requires that base and fixed stations reduce power into the public safety bands by a factor of 76 + 10 log P dB.

[30] Motorola did not seek reconsideration of the original decision in the *700 MHz First Report and Order* to permit fixed stations to operate in the upper band — though it had previously indicated that it considered potential interference to public safety base stations from fixed stations operating in the upper 700 MHz spectrum to be a concern. Motorola Petition, Appendix A at 16.

[31] That is, public safety systems generally employ a single, high-powered base station to cover a relatively wide area, while commercial, cellular-type systems use a large number of lower-powered base stations to cover the same geographic area.

[32] This would be the case regardless of whether we assume that, as Motorola contends, interference to a public safety base station receiver could occur from a commercial base station transmitter operating as far away as 4.8 km, or whether we assume that interference could occur only from commercial base stations operating as close as 400-700 m from a public safety base station receiver.

procedures fail to resolve the interference, we will consider other appropriate mitigation measures, including requiring: 1) greater out-of-band attenuation of commercial transmitters;[33] 2) the use of directional antennas; or 3) the use of additional filtering. We also believe that this decision is responsive to the concerns raised by APCO in its December 21, 2000 *ex parte* filing.[34]

14. Lastly, Motorola seeks clarification as to the appropriate out-of-band emission standard for control stations operating in the commercial bands. We clarify herein that control stations, which are fixed stations, must comply with the same 76 + 10 log P emission standard that applies to all base and fixed stations.

IV. ORDERING CLAUSES

15. Authority. This action is taken pursuant to Sections 1, 4(i), 7, 10, 201, 202, 208, 214, 301, 303, 307, 308, 309(j), 309(k), 310, 311, 315, 316, 317, 319, 324, 331, 332, 336, 337 and 614 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 157, 160, 201, 202, 208, 214, 301, 303, 307, 308, 309(j), 309(k), 310, 311, 315, 316, 317, 319, 324, 331, 332, 336, 337, and 534, and the Consolidated Appropriations Act, 2000, Pub. Law 106-113, 113 Stat. 1501, Section 213.

16. IT IS ORDERED that the Petition for Reconsideration or Clarification, filed by Motorola, Inc., IS DENIED, and that, in accordance with Section 213 of the Consolidated Appropriations Act, 2000, Pub. Law 106-113, 113 Stat. 1501 (1999), this action shall be effective immediately upon publication in the Federal Register.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary

[33] *See* 47 C.F.R. § 27.53(f).

[34] *See APCO Letter.*

APPENDIX A

Petition for Reconsideration

Motorola, Inc.

Oppositions

Adaptive Broadband Corporation
ArrayComm, Inc.
BellSouth Corporation
TRW Inc.

Reply to Oppositions

Motorola, Inc.

***Ex Parte* Comments**

Motorola, Inc.
Association of Public-Safety Communications Officials International, Inc.